

## 6.9L (IDI) Diesel Engine Diagnostics Guide

|                        |                          |                     |   |  |
|------------------------|--------------------------|---------------------|---|--|
| <br><b>6.9L DIESEL</b> | CUSTOMER NAME            | DEALER NAME         | P & A CODE  | -NOTE-<br>IF CONCERN IS FOUND, SERVICE AS<br>REQUIRED. IF THIS CORRECTS THE<br>CONDITION, IT IS NOT NECESSARY<br>TO COMPLETE THE REMAINDER OF<br>THE DIAGNOSTIC PROCEDURE. |
|                        | MODEL AND YEAR           | VEHICLE GVW         | TRANSMISSION  |  |
|                        | VEHICLE SERIAL NO. (VIN) | AMBIENT TEMPERATURE | ODOMETER  |  |
| DATE:                  | ENGINE SERIAL NO.        | 1863 CLAIM NO.      | TYPE OF SERVICE   |  |
|                        |                          |                     | PERSONAL <input type="checkbox"/> COMMERCIAL <input type="checkbox"/> |  |

**Customer Concerns** (Please list concern(s) in this box).  
 > If concern is exhaust smoke, see "Evaluating Normal Exhaust Smoke", right lower corner.

### TESTS Page 1 of 4

**UNLESS SPECIFIED ALL TEST ARE TO BE RUN WITH TRANSMISSION IN NEUTRAL (PARK) AND REAR WHEEL OFF THE GROUND**

**1. EXTERNAL LEAKAGE -- See Illustration -- Reverse Side**

Oil    Air Intake    Water    Fuel

Record Location of leaks below in Problem Found box.      Record location of the leaks on Illustration - Reverse Side

|                                       |           |             |
|---------------------------------------|-----------|-------------|
| INSTRUMENT                            | 1st CHECK | 2nd CHECK ◆ |
| Visual Check <input type="checkbox"/> |           |             |

**2. EXHAUST SYSTEM CONDITION -- See Illustration -- Reverse Side**

Inspect for dents or kinks which could cause a restriction.  
 Record defects in the Problem found box.

|                                       |       |
|---------------------------------------|-------|
| INSTRUMENT                            | CHECK |
| Visual Check <input type="checkbox"/> |       |

**3. CHECK FOR FUEL QUALITY -- See Illustration -- Reverse Side**

**A. CHECK FOR AIR IN FUEL**

Install an appropriate length of clear PVC hose in place of the rubber hose on the fuel filter outlet. Run engine at 3000 RPM for 2 minutes then observe clear fuel hose for bubbles in fuel with engine at 3000 RPM. Fuel should be free of bubbles within 2 minutes. Correct fuel flow direction is from the fuel filter towards the fuel return system (injection nozzles). Fuel flow in the opposite direction indicates an restricted fuel supply system. fitting and a restricted fuel supply system.

| INSTRUMENT     | GUIDELINE DATA                     | CHECK      |           |
|----------------|------------------------------------|------------|-----------|
| Clear PVC Hose | BUBBLES LESS THAN 1/16th INCH DIA. | Front Tank | Rear Tank |

- Flow direction OK and bubbles less than 1/16 inch diameter - Go to test 3B.
- Flow direction OK and bubbles 1/16 inch diameter or greater - Go to fuel system diagnostic procedure (see Car/Truck Emission Diagnosis Shop Manual, Volume H, and return to test 3A when leak is determined.
- Flow direction NOT OK - Go to test 4 Return to test 3A when flow direction OK.

**B. CHECK FOR FUEL CONTAMINATION**

Obtain a fuel sample and visually examine the sample of fuel in a clear container (including bottom of container) for particles, clouding or other liquid contamination such as water.

|                 |       |
|-----------------|-------|
| INSTRUMENT      | CHECK |
| Clear Container |       |

- If no contamination is found - Go to test 3C.
- If contamination is found - replace filter and clean or repair chassis fuel system. Go to test 3C and inform owner about fuel quality.

**C. CHECK FOR FUEL CETANE VALUE**

Using fuel sample from test 3B, check cetane value.

| INSTRUMENT                  | GUIDELINE DATA             | OBSERVED CETANE VALUE |
|-----------------------------|----------------------------|-----------------------|
| 78-0100 Cetane Value Tester | Minimum Cetane Value of 40 |                       |

- If Cetane value is OK, Go to test 4
- If Cetane value is below 40, complete test 6, 10 and 11, return vehicle to customer and inform customer that vehicle contains substandard fuel and fuel source should be changed.

**NOTE: DO NOT REPLACE FUEL INJECTION PUMP FOR THIS CONCERN.**

**\*\* SEE REVERSE SIDE FOR TEST HARDWARE INSTALLATION \*\* ENGINE MUST BE AT NORMAL OPERATING TEMPERATURE**  
 ◆ 2nd CHECK SHOULD BE PERFORMED ONLY AS INDICATED AND TO VERIFY CORRECTIVE ACTION.

What problems were found and what repairs were performed?

**4. FUEL SUPPLY SYSTEM -- See Illustration -- Reverse Side**

**A. CHECK FUEL FILTER OUTLET PRESSURE - Record "value" Below**

Measure at 3300 RPM with accessories turned off.

| INSTRUMENT                        | GUIDELINE DATA  | 1ST CHECK (PSI) |           | 2ND CHECK (PSI) |           |
|-----------------------------------|-----------------|-----------------|-----------|-----------------|-----------|
| 0 - 15 PSI Gauge and 5651 Adapter | 1.0 PSI MINIMUM | Front Tank      | Rear Tank | Front Tank      | Rear Tank |

- If pressure meet guideline, - Go to test 4C.
- If pressure is low - Go to test 4B.

**B. FUEL SUPPLY PUMP OUTLET PRESSURE - Record "value" Below**

Measure at 675 RPM with accessories turned off.

| INSTRUMENT                        | GUIDELINE DATA  | 1ST CHECK (PSI) |           | 2ND CHECK (PSI) |           |
|-----------------------------------|-----------------|-----------------|-----------|-----------------|-----------|
| 0 - 15 PSI Gauge and 3019 Adapter | 2.0 PSI MINIMUM | Front Tank      | Rear Tank | Front Tank      | Rear Tank |

- If pressure meets guideline, replace fuel filter and repeat test 4A.
- If pressure is low - Go to 4C.

**C. \*\* FUEL PUMP CAPACITY - Record Volume in 30 sec. Below**

Measure at 675 RPM with accessories turned off.

| INSTRUMENT                                 | GUIDELINE DATA                  | 1ST CHECK (sec) |           | 2ND CHECK (sec) |           |
|--|---------------------------------|-----------------|-----------|-----------------|-----------|
| Graduated 1 Qt. Container and 3019 Adapter | MINIMUM OF 1 PINT IN 30 SECONDS | Front Tank      | Rear Tank | Front Tank      | Rear Tank |

- If pressure and volume meet guideline, - Go to test 5.
- Pressure OK and Volume NOT OK - Go to 4D.
- Volume OK and Pressure NOT OK - replace fuel supply pump and repeat test 4A.
- Pressure and Volume NOT OK - Go to 4D.

**D. CHECK RESTRICTION AT SUPPLY PUMP INLET - Record "Value" Below**

Measure at 3300 RPM with accessories turned off.

| INSTRUMENT                                   | GUIDELINE DATA             | 1ST CHECK (In.-Hg) |           | 2ND CHECK (In.-Hg) |           |
|--|----------------------------|--------------------|-----------|--------------------|-----------|
| 0 - 30 In.-Hg. Vacuum Gauge and 5632 Adapter | LESS THAN 6 In.-Hg. VACUUM | Front Tank         | Rear Tank | Front Tank         | Rear Tank |

- If vacuum is 6 In.-Hg. or greater - repair restriction in chassis fuel system and repeat test 4A.
- If vacuum is less than 6 In.-Hg. - replace fuel supply pump and repeat test 4A.

**5. CHECK FUEL RETURN LINE PRESSURE -- See Illustration -- Reverse Side**

Check pressure at junction of engine adapter and chassis return hose.  
 NOTE: Return line removed in test 4A must be reconnected.

Measure at 3300 RPM with accessories turned off. Record "Value" below.

| INSTRUMENT                        | GUIDELINE DATA    | 1ST CHECK (PSI) |           | 2ND CHECK (PSI) |           |
|-----------------------------------|-------------------|-----------------|-----------|-----------------|-----------|
| 0 - 15 PSI Gauge and 5663 Adapter | LESS THAN 2.0 PSI | Front Tank      | Rear Tank | Front Tank      | Rear Tank |

**6. AIR INTAKE RESTRICTION -- See Illustration -- Reverse Side**

Measure at 3300 RPM with accessories turned off. Record "Value" below.

| INSTRUMENT                    | GUIDELINE DATA         | 1ST CHECK (In. of H2O) |  | 2ND CHECK (In. of H2O) |  |
|-------------------------------|------------------------|------------------------|--|------------------------|--|
| 19-0002 Test Kit 5650 Adapter | BETWEEN 2" AND 25" H2O |                        |  |                        |  |

- If above 25", replace filter element and retest.
- If less than 2" of water correct restriction in air cleaner fitting.
- If within guidelines, Go to test 7.

|   |  |
|---|--|
| List Part Name, Number and Serial Number of parts replaced. |  |
|---|--|

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|                        |                          |                     |   |  |
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|                        | MODEL AND YEAR           | VEHICLE GVW         | TRANSMISSION  |  |
|                        | VEHICLE SERIAL NO. (VIN) | AMBIENT TEMPERATURE | ODOMETER  |  |
| DATE:                  | ENGINE SERIAL NO.        | 1983 CLAIM NO.      | TYPE OF SERVICE   |  |
|                        |                          |                     | PERSONAL <input type="checkbox"/> COMMERCIAL <input type="checkbox"/> |  |

### Customer Concerns (Please list concern(s) in this box).

> If concern is exhaust smoke, see "Evaluating Normal Exhaust Smoke", right lower corner.

## TESTS Page 2 of 4

### 7. CHECK INJECTION PUMP TRANSFER PRESSURE - See Illustration

- Reverse Side

Remove screw from transfer pump pressure port and install tool through cover and O-Ring into the port.

Measure at 3300 RPM with accessories turned off.

| INSTRUMENT                                   | GUIDELINE DATA                  | 1ST CHECK | 2ND CHECK |
|--|---------------------------------|-----------|-----------|
| T83T-9000-A 0-160 PSI Gauge and 5650 Adapter | 90 Min - 110 Max PSI @ 3300 RPM |           |           |

\* If pressure is not to specification, replace fuel injection pump.

### 8. ACCELERATOR LINKAGE - See Illustration - Reverse Side

Throttle lever contacts stop at full pedal depression.

| INSTRUMENT                            | 1ST CHECK | 2ND CHECK |
|---------------------------------------|-----------|-----------|
| Visual Check <input type="checkbox"/> |           |           |

### 9. \*\* LOW IDLE (RPM) - See Illustration - Reverse Side

\* Automatic transmission in drive position. - Record "Value" below.

\* Manual transmission in neutral position. - Record "Value" below.

| INSTRUMENT         | GUIDELINE DATA      | 1ST CHECK | 2ND CHECK |
|--------------------|---------------------|-----------|-----------|
| 89-8001 TACHOMETER | SEE EMISSIONS LABEL |           |           |

### 10. INJECTION PUMP TIMING - See Illustration - Reverse Side

Install luminosity probe in #1 glow plug hole and connect dynamic timing meter. Dial in 20° offset on meter. Disconnect cold start advance solenoid connector (shown in figure 10 on reverse side) from the solenoid terminal. Maintain 1400 RPM on a warm (operating temperature) engine and record dynamic timing in Box (A). Apply battery voltage to solenoid terminal, maintain 1400 RPM and record dynamic timing in Box (B).

| INSTRUMENT              | GUIDELINE DATA                             | 1ST CHECK | 2ND CHECK |
|-------------------------|--|-----------|-----------|
| 078-0100 Dynamic Timing | A) Check with no power to advance solenoid |           |           |
|                         | B) Check with power to advance solenoid    |           |           |

\* If (B) is more than 2.5° advance from (A) compare (A) to respective number in timing specification Chart on back of form and reset if not within ± 2°.

\* If (B) is less than 2.5° advance from (A), replace fuel injection pump top cover assembly.

### 11. CHECK INJECTION LINES AND INJECTION NOZZLES

- See Illustration - Reverse Side

**NOTE: PERFORM THIS CHECK ONLY IF ENGINE OBVIOUS COMBUSTION KNOCK OR MISS.**

Check injection lines for kinks and/or restrictions. Remove nozzles and test opening pressure and tip leakage on each nozzle. No other evaluation should be performed.

**CAUTION:** Keep hands and other parts of the body away from the spraying nozzle. The liquid discharge leaves the nozzle tip with sufficient force to penetrate the skin and cause serious injury. The nozzle tip should be surrounded by a transparent receptacle if available.

#### OPENING PRESSURE AND TIP LEAKAGE

- A. Connect nozzle to nozzle tester. Bleed air from nozzle by pumping tester 10 times to insure steady fuel spray from tip. Pump tester slowly and record highest pressure reached prior to the nozzle opening (discharging fluid) and Record in Box (A) below.
- B. Ensure that nozzle body and tip are completely dry before starting test. Operate tester to maintain pressure for 5 seconds at 200 PSI below nozzle opening pressure recorded in (A) for each nozzle. Nozzle tip can be wet in 5 seconds but a droplet should not fall.

### CHECK INJECTION LINES AND INJECTION NOZZLES CONT.

| INSTRUMENT | GUIDELINE DATA | 1983 and Early 1984 Engines       | 1984 and Mid-Year Later Engines                                 |
|------------|----------------|-----------------------------------|---|
|            |                | 014-00300 Injection Nozzle Tester | Engine Calibration Code on Nozzle Body Minimum Opening Pressure |

| NOZZLE #                      | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|-------------------------------|---|---|---|---|---|---|---|---|
| (A) Opening Pressure (PSI)    |   |   |   |   |   |   |   |   |
| (B) Tip Leakage (OK / NOT OK) |   |   |   |   |   |   |   |   |

### 12. CRANKCASE PRESSURE - See Illustration - Reverse Side

Measure pressure at oil fill pipe. Remove crankcase depression regulator (CDR) valve.

Plug crankcase opening by inserting a clean piece of cardboard between CDR valve and seal ring. Retighten CDR and insure dipstick is seated tube. Remove cardboard upon completion of test.

\* Measure at 3300 RPM with accessories turned off. Record "Value" below.

| INSTRUMENT                     | GUIDELINE DATA                     | 1st CHECK | 2ND CHECK |
|--------------------------------|------------------------------------|-----------|-----------|
| 019-0002 Test Kit 5631 Adapter | MAXIMUM PRESSURE OF 6 IN. OF WATER |           |           |

\* If pressure is not to specification, there is an internal engine concern.

\* IF THE PERFORMANCE CONCERN STILL EXISTS AFTER COMPLETION OF THE ENGINE PERFORMANCE CHART REPLACE THE INJECTION PUMP.

**NOTE: WARRANTY CLAIMS FOR THE INJECTION PUMP WILL NOT BE ACCEPTED UNLESS ALL TAMPER RESISTANT SEALS ARE INTACT AND THE COMPLETED ENGINE PERFORMANCE CHART (VALUES RECORDED) IS SUBMITTED WITH THE RETURNED PART.**

### EVALUATING NORMAL EXHAUST SMOKE

#### BLUE-WHITE SMOKE CAN BE OBSERVED

- \* After engine startup at all engine temperatures, and at all ambient temperatures.
- \* At low idle speeds after cold engine startup - this smoke will clear up soon after vehicle is driven.
- \* When ambient temperature is below 50 F, blue - white smoke can return after the engine warm-up period due to extended idling time (ten minutes or more).

#### BLACK SMOKE CAN BE OBSERVED

- \* When pulling hard, such as going up a steep grade.
- \* When heavily loaded, such as pulling a trailer or operating with a heavy load in the truck bed.
- \* During heavy acceleration.

**NOTE:** Black smoke under the above conditions will be much more pronounced at higher altitudes.

**THIS GUIDE SHOULD BE USED IN CONJUNCTION WITH THE 1986 CAR/TRUCK SHOP MANUAL - "ENGINE/EMISSIONS DIAGNOSIS" - VOLUME H.**

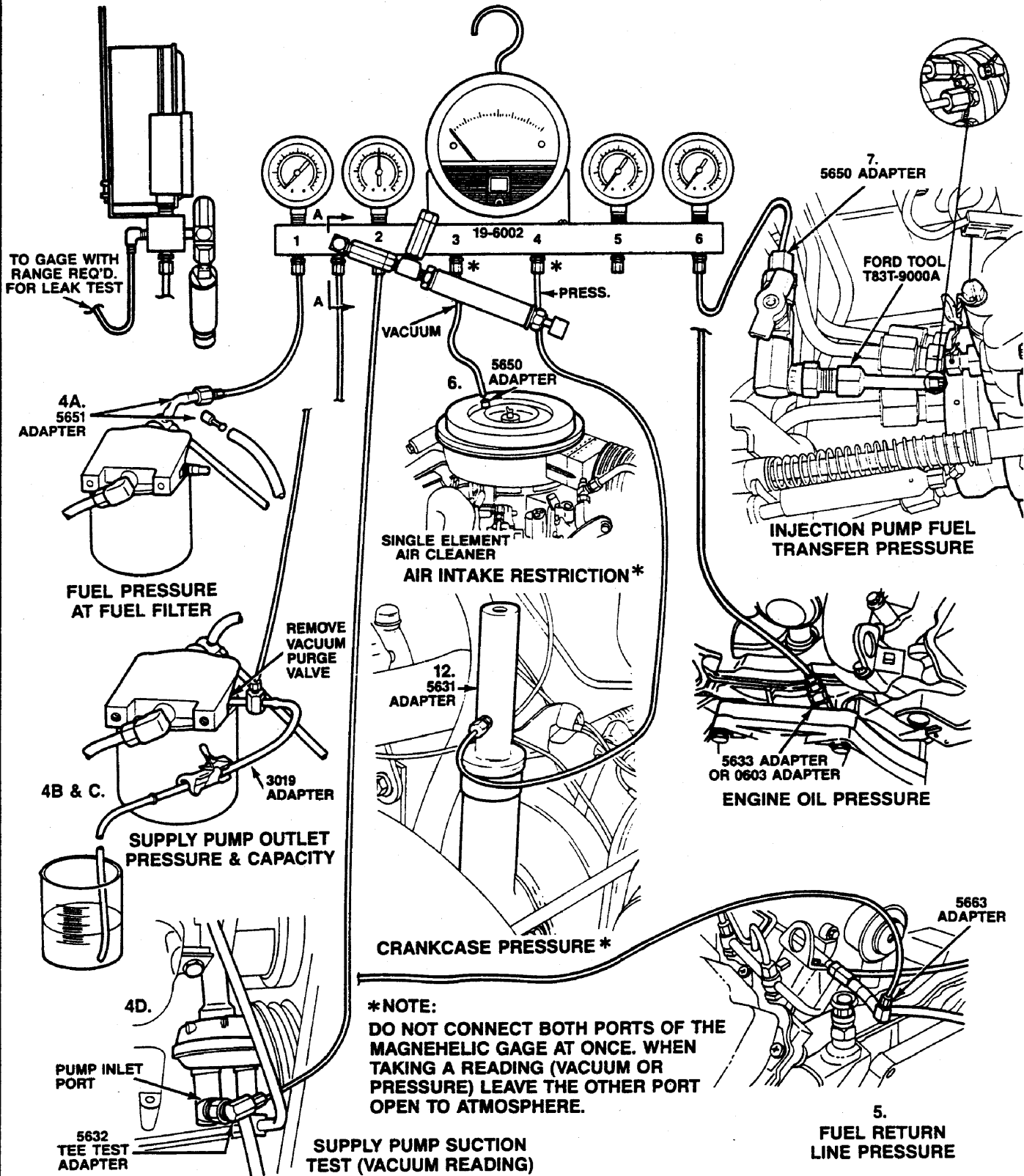
\* SEE REVERSE SIDE FOR TEST HARDWARE INSTALLATION \*\* ENGINE MUST BE AT NORMAL OPERATING TEMPERATURE

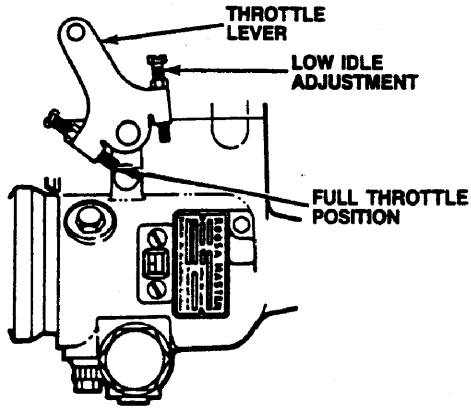
◆ 2nd CHECK SHOULD BE PERFORMED ONLY AS INDICATED AND TO VERIFY CORRECTIVE ACTION.

What problems were found and what repairs were performed?

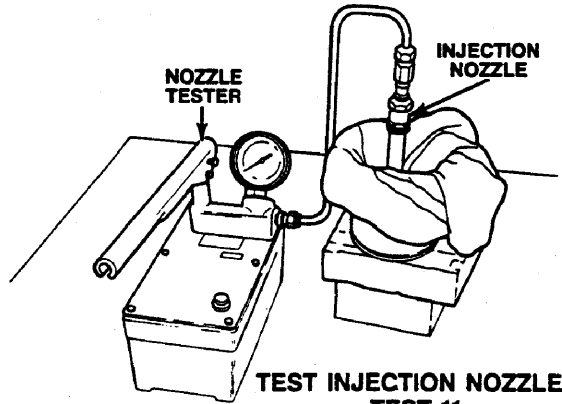
List Part Name, Number and Serial Number of parts replaced.

# SETUP ILLUSTRATION OF ROTUNDA™ 19-0002 PRESSURE TEST KIT AND TEST FITTINGS

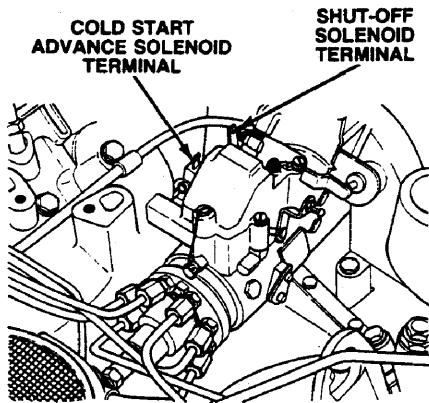




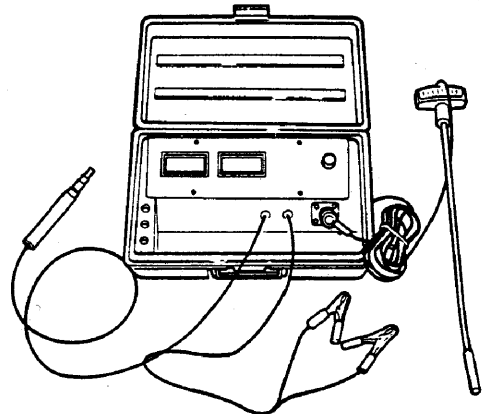
**ACCELERATOR LINKAGE  
TEST 8 AND 9**



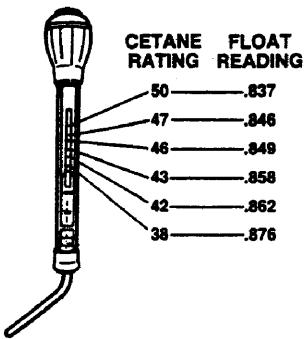
**TEST INJECTION NOZZLES  
TEST 11**



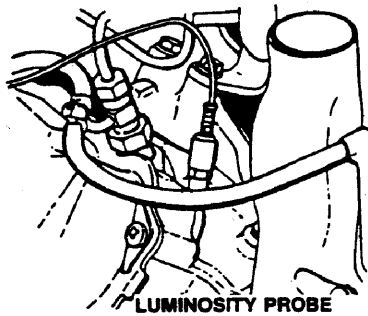
**INJECTION TIMING  
TEST 10**



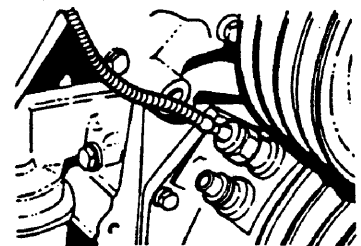
**TIMING METER  
AND TACHOMETER  
TEST 9 AND 10**



**TEST FUEL QUALITY  
TEST 3**



**LUMINOSITY PROBE**



**MAGNETIC PICK-UP**

**DYNAMIC INJECTION TIMING  
TEST 10**

## 6.9L DIESEL DYNAMIC TIMING SPECIFICATIONS

Calibration labels are on the front of the injection pump gear housing. Dynamic timing specifications are shown below.

Calibrations 468J-R00 and 468X-R00  
1984 Model Running Change and Later

| FUEL CETANE VALUE | CALIBRATION |           |
|-------------------|-------------|-----------|
|                   | 468J-R00    | 468X-R00  |
| 38-42             | 3.5° ATDC   | 4.5° ATDC |
| 43-46             | 2.5° ATDC   | 3.5° ATDC |
| 47 or GREATER     | 1.5° ATDC   | 2.5° ATDC |

Installation or resetting tolerance for dynamic timing is  $\pm 1^\circ$ . Service limit is  $\pm 2^\circ$ .

Calibrations 368J-R00 and 368X-R00  
1983 and Early 1984 Models

| FUEL CETANE VALUE | CALIBRATION |          |
|-------------------|-------------|----------|
|                   | 368J-R00    | 368X-R00 |
| 38-42             | 6° ATDC     | 7° ATDC  |
| 43-46             | 5° ATDC     | 6° ATDC  |
| 47 or GREATER     | 4° ATDC     | 5° ATDC  |

Installation or resetting tolerance for dynamic timing is  $\pm 1^\circ$ . Service limit is  $\pm 2^\circ$ .

### ENGINE TIMING SPECIFICATIONS TEST 10